

Vacuum Cleaner**BACKGROUND OF THE INVENTION**

1. Field of the Invention

[0001] This invention relates to a vacuum cleaner.

2. Related Background Art

[0002] Vacuum cleaners conventionally comprise a permeable dust bag, which filters and retains the dirt and dust drawn into the vacuum cleaner by the induced air flow. Nowadays, it has become popular to provide vacuum cleaners, in which the separated dirt and dust is collected in a rigid dirt receptacle that can be emptied and re-used. Such so-called bagless cleaners alleviate the need to purchase and replace the dust bags. However, a disadvantage of re-usable dirt receptacles is that the receptacles are often dirty to handle and clouds of dirt and dust can be emitted into the atmosphere when the receptacles are emptied, with the obvious health risks and resultant contamination of the vacuum cleaner and the user's environment with a layer of dust.

[0003] Many bagless vacuum cleaners nowadays comprise a cyclonic separator, which deposits the separated dirt and dust in a rigid dirt receptacle. Cyclonic vacuum cleaners offer the advantage over bag-type cleaners of maintaining a more constant level of suction performance regardless of the quantity of dirt present in their dirt receptacle.

[0004] One of the main disadvantages of known cyclonic vacuum cleaners is that the procedure for emptying their dirt receptacles is a potentially dirty and unhygienic process. Instead of simply removing a closed paper bag full of dirt from the vacuum cleaner, and dropping it into a dustbin, emptying a cyclonic cleaner usually involves tipping a mass of loose dust and dirt out of its dirt receptacle, following removal of the receptacle from the cleaner. This emptying process can involve knocking and/or shaking the dirt receptacle to dislodge

agglomerated dust and any masses of fibrous material, such as fluff and hairs that may be present.

[0005] This problem is exacerbated because fine dirt typically collects at the base of the dirt receptacle, with coarse and
5 fibrous dirt lodging in the upper region of the receptacle. When the dirt receptacle is inverted for emptying, the entire mass of dirt falls in an uncontrolled manner into the vessel used for its final disposal, typically a dustbin or refuse bag. This uncontrolled discharge usually results in the lighter dirt
10 fractions being disturbed by the movement of the heavier fractions, whereupon the clothing and anatomy of the vacuum cleaner user may become contaminated with dust. The attendant escape of dust into the user's home environment is equally undesirable.

15 **[0006]** Many popular cyclonic vacuum cleaners have a simple cylindrical dirt receptacle, usually of transparent plastic material, which is removed from the cleaner and inverted over the dustbin for emptying. More recent cleaners have had a pivoted flap at the bottom of their dirt receptacle, this being
20 released by some form of manually-operated latch to swing open for emptying under gravity or, in some cases, being spring-loaded to aid opening. In either case, dust and fibres suddenly fall out of the dirt receptacle when the flap opens. This flap-type emptying system exacerbates the problem of
25 contamination, since the fine dust falls out of the bottom of the receptacle closely followed by the coarse and fibrous dirt, which falls through and/or lands on top of the fine dust causing clouds of fine dust to become airborne and contaminate the environment during the emptying process.

30 **[0007]** Thus, there is the need to provide a dirt receptacle for a cyclonic vacuum cleaner which is clean to use and does not generate clouds of dirt and dust when emptied.

[0008] EP 1 199 023 attempts to solve the above-mentioned problems by providing a cyclonic separator for a vacuum cleaner
35 in which the lower region of the cylindrical dirt receptacle

is separated from the upper region by a perforated disc-shaped partition. In use, the fine dust and dirt particles fall through the perforations in the disc and are retained in the region below the disc. The coarser particulate and fibrous material are retained above the disc. During emptying, the lower region of the dirt receptacle can be opened and carefully emptied into a suitable waste receptacle for disposal. Having emptied the fine dust, the entire dirt receptacle containing the coarse and fibrous material, may then be inverted over the waste receptacle to complete the emptying process.

[0009] Although the dirt receptacle emptying arrangement disclosed in EP 1 199 023 constitutes a considerable improvement over the emptying arrangements of most commercially available cyclonic cleaners, the receptacle is complicated and expensive in construction and is difficult to use.

[0010] We have now devised a vacuum cleaner which alleviates the above-mentioned problems.

SUMMARY OF THE INVENTION

[0011] In accordance with this invention, there is provided a dirt receptacle for a vacuum cleaner, the receptacle comprising a rigid container having an outlet for the emptying of collected dirt, a closure for closing the outlet, and an actuator for moving the closure between a closed position and an open position, said actuator being operable to control the position of the closure between said open and closed positions.

[0012] In use, the receptacle is emptied by initially moving the closure to a partially opened position, in which fine dirt and dust can be emptied through the restricted outlet in a controlled manner. The restricted size of the outlet retains any coarser and fibrous dirt inside the receptacle. Once the fine dirt has been emptied, the closure can be moved to its fully open position to allow the coarse dirt and fibrous matter to be emptied from the receptacle.

[0013] The present invention thus provides a clean and hygienic way of emptying the receptacle by allowing the fine and coarse dirt to be emptied in two distinct operating stages, thereby avoiding the problem of dust contamination when all of
5 the dirt is released in an uncontrolled single stage.

[0014] The restricted size of the opening also allows a more controlled release of the fine dirt and avoids the problem of dust contamination caused by a sudden release of the dirt.

[0015] The receptacle is simple and inexpensive in
10 construction and is straightforward to use.

[0016] Preferably, the closure locates at said partially opened position, in order to provide a tactile indication to the user that the closure is in the correct position for the emptying of fine dust.

15 [0017] Preferably, the outlet is provided at a position on the container which is located at the bottom thereof when the container is in use, such that the outlet is positioned directly adjacent the fine dirt which collects at the bottom of the container.

20 [0018] Preferably means are provided for retaining the closure in said open and/or closed positions.

[0019] Preferably the closure is biased into said fully open position

[0020] Preferably, the container comprises an open bottom
25 forming the outlet.

[0021] Preferably, the closure comprises a flap pivoted to the container.

[0022] Preferably the actuator comprises a handle mounted directly to said flap, preferably adjacent the point where the
30 flap is pivoted to the container.

[0023] Preferably the flap is also mounted to the container for translatory movement towards and away from said outlet thereof.

[0024] Preferably means are provided to guide the translatory movement of said flap towards and away from said outlet.

[0025] Preferably said guide means is arranged to only permit pivotal movement of the flap, when the latter is in a partially
5 opened position between said open and closed positions.

[0026] Preferably, the guide means is arranged to hold said flap in its fully opened position.

[0027] Also, in accordance with this invention, there is provided a vacuum cleaner comprising a dirt receptacle as
10 hereinbefore described.

[0028] Preferably the vacuum cleaner comprises a cyclonic separator having a cylindrical-walled separation chamber.

[0029] Also, in accordance with this invention, there is provided a method of emptying a dirt receptacle of a vacuum
15 cleaner, the receptacle comprising a rigid container having an outlet for the emptying of collected dirt, a closure for closing the outlet, the closure being moveable between a normally closed position and an open position, the method comprising removing the dirt receptacle from the vacuum
20 cleaner, partially opening the closure and emptying fine dirt from the receptacle through the restricted outlet prior to fully opening the closure and emptying the remaining dirt from the receptacle.

BRIEF DESCRIPTION OF THE DRAWINGS

25 [0030] Embodiments of this invention will now be described by way of examples only and with reference to the accompanying drawings, in which:

[0031] Figure 1 is a schematic view of a vacuum cleaner in accordance with this invention;

30 [0032] Figure 2 is a perspective view of a dirt collection bin of the cleaner of Figure 1, showing the discharge flap thereof in its closed state;

[0033] Figure 3 is a side view of the dirt collection bin of the cleaner of Figure 1, showing the discharge flap thereof in its closed state;

[0034] Figure 4 is a perspective view of a dirt collection bin of the cleaner of Figure 1, showing the discharge flap thereof in its partially opened state;

[0035] Figure 5 is a side view of the dirt collection bin of the cleaner of Figure 1, showing the discharge flap thereof in its partially opened state;

[0036] Figure 6 is a perspective view of a dirt collection bin of the cleaner of Figure 1, showing the discharge flap thereof in its fully opened state;

[0037] Figure 7 is a side view of the dirt collection bin of the cleaner of Figure 1, showing the discharge flap thereof in its fully opened state;

[0038] Figure 8 is a perspective view of a dirt collection bin of an alternative embodiment of vacuum cleaner in accordance with this invention, showing the discharge flap thereof in its closed state;

[0039] Figure 9 is a perspective view of the dirt collection bin of Figure 8, showing the discharge flap thereof in its fully opened state;

[0040] Figure 10 is a perspective view of a portion of a dirt collection bin of a preferred embodiment of vacuum cleaner in accordance with this invention, showing the discharge flap thereof in its closed state;

[0041] Figure 11 is a perspective view of a portion of the dirt collection bin of Figure 10, showing the discharge flap thereof in its partially opened state;

[0042] Figure 12 is a perspective view of a portion of the dirt collection bin of Figure 10, showing the discharge flap thereof in its fully opened state; and

[0043] Figure 13 is a longitudinal sectional view through a portion of the dirt collection bin of Figure 10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0044] Referring to Figure 1 of the drawings, there is shown an upright vacuum cleaner comprising a wheeled suction head 10, to which a body portion 11 is pivoted for movement between an upright position and an inclined operative position. A motor and fan are mounted in a bottom portion 12 of the body 11 of the cleaner.

[0045] A separation unit 13 mounted in the body 11 of the cleaner comprises a cyclone separator and a filter. In use, the fan induces an airflow through the cleaner from the suction head 10 through the separation unit 13, where dirt and dust separated from the airflow by the cyclone is collected in a removable dirt collection bin 14 mounted directly below the separation unit 13. The cyclone separator comprises a cylindrical wall and for practical purposes, the side wall of the collection bin 14 is a downward extension of the wall of the cyclone.

[0046] The cyclonic separation action causes the finer dirt particles F to collect at the bottom of the collection bin 14 below the coarser dirt particles and fibrous matter C.

[0047] Referring to Figures 2 and 3 of the drawings, the collection bin 14 comprises a cylindrical side wall 15 having an open top which communicates with the cyclone separator. The bottom of the bin 14 is closed by a flap 16 which is pivoted by a shaft to the side wall 15 of the bin 14 for rotation about an axis which extends perpendicular to the longitudinal axis of the bin. A torsion spring 17 biases the flap 16 downwardly into a position where the bottom of the bin 14 is fully open.

[0048] The flap 16 comprises a pair of spaced-apart formations 18, between which the above-mentioned shaft extends. Each formation 18 comprises an outwardly facing abutment surface which lies in a plane that extends parallel to both the longitudinal axis of the bin and rotational axis of the flap 16, when the latter is in its fully closed position.

[0049] An actuator 19 is slidably mounted to the outer surface of the side wall 15 of the bin 14 for movement in a direction which extends parallel to the longitudinal axis of the bin. The actuator 19 comprises a pair of arms having lower ends which
5 abut the respective flap formations 18.

[0050] A foldable handle 20 is attached to the arms of the actuator 19 for sliding the actuator 19 in the upward and downward directions shown in the drawings. In its fully downward position, the bottom ends of the arms of the actuator
10 19 bear against the abutment surface of the flap formations 18, thereby holding the flap in its closed position and preventing the collected dirt and dust from falling out of the bottom of the bin 14 whilst the cleaner is in use and whilst the bin 14 is being carried to a waste receptacle for emptying. The handle
15 20 also serves as a handle for supporting the bin 14 whilst it is being carried.

[0051] Referring to Figures 4 and 5 of the drawings, in order to empty the bin 14, the user slides the actuator 19 upwardly using the handle 20, thereby allowing the flap 16 to open under
20 the spring bias, until the bottom ends of the arms of the actuator 19 engage in respective detents 21 formed in the abutment surfaces of the flap formations 18. In this position, the flap 16 is retained in the partially open position and the fine dirt and dust F at the bottom of the bin 14 can be emptied
25 through the small opening at the bottom of the bin 14. Any coarse dirt and fibrous matter C cannot pass through the opening and is retained inside the bin 14.

[0052] Referring to Figures 6 and 7 of the drawings, in order to fully empty the bin 14, the user has to slide the actuator
30 19 more upwardly using handle 20, thereby allowing the flap 16 to fully open under the applied spring bias. In this position, all of the remaining dirt and dust inside the bin 14 is free to fall through the open bottom of the bin 14.

[0053] Following emptying of the bin 14, the actuator 19 is
35 returned to its lower position using the handle 20, thereby

closing the flap 16 against the spring bias. The body 11 of the cleaner is preferably adapted such that the bin 14 cannot be mounted to the cleaner until the actuator 19 has been returned to the lower position, thereby avoiding the risk of the flap 16 opening whilst the bin 14 is removed from the cleaner.

[0054] The upper surface of the flap 16 is contaminated with dirt and dust. However, it will be appreciated that actuator 19 enables the user to open and close the flap 16 without having to touch the flap itself.

10 **[0055]** Referring to Figures 8 and 9 of the drawings, there is shown an alternative embodiment of a bin 14, which is similar to the above-mentioned bin and like parts are given like reference numerals. In this embodiment, a pair of pinions 42 are mounted to the flap 16 for rotation about the rotational axis of the flap 16. A handle 40 is pivotally mounted to the external surface of the wall 15 of the bin 14 for rotation about an axis which extends parallel to the axis of flap rotation. A second pair of pinions 41 are mounted to the handle 40 and are engaged with respective ones of the flap pinions 42.

15 **[0056]** In order to open the flap 16, the handle 40 is rotated about its rotational axis, causing the pinions 41 to correspondingly turn the flap pinions 42. A detent (not shown) is provided to retain the flap 16 in its partially opened position and to provide a tactile indication to the user that the flap 16 is in the correct position for the emptying of fine dirt.

20 **[0057]** Referring to Figures 10 to 13 of the drawings, there is shown a preferred embodiment of a bin 14, which is similar to the above-mentioned bins and like parts are given like reference numerals. The flap 16 is pivotally mounted between a pair of parallel spaced apart flanges 52 provided on the lower end of the rear of the side wall 15 of the bin 14. The flanges 52 extend parallel to each other and axially of the bin. Each flange 52 comprises an upper slot 53 which extends

axially of the bin and a lower u-shaped slot 54 having long and short arms 54a, 54b extending axially of the bin.

[0058] The flap 16 comprises a portion 56 which extends between the flanges 52. A pair of upper projections 55 extend
5 outwardly from opposite sides of the flap extension 56 into the respective upper slots 53 of the flanges 52. A pair of lower projections 57 also extend outwardly from opposite sides of the flap extension 56 into the respective lower slots 54 of the flanges 52.

10 **[0059]** A handle 58 extends over the outer surface of the flap extension 56. The lower edge of the handle 58 is spaced away from the outer surface of the flap extension 56, so that a user can grasp the handle 58 in the palm of their hand, with their fingers extending around the lower edge of the handle. A
15 concealed spring 59, connected between the flap extension 56 and the exterior of the wall 15 of the bin 14, biases the flap 16 upwardly. A seal 59 extends around the flap 16 to seal against the bottom edge of the wall 15 of the bin 14.

[0060] In use, when the bin 14 is stowed on the body 11 of the
20 vacuum cleaner, the flap 16 is in the closed position of Figure 10. The spring 59 serves to retain the flap 16 in the closed position, so that no dirt and dust can escape. The handle 58 is preferably concealed behind the bin 14 when the latter is stowed on the body 11 of the vacuum cleaner.

25 **[0061]** In order to empty the bin 14, the user removes the bin 14 from the body 11 of the cleaner. The user then pushes the handle 58 downwardly, thereby allowing the flap 16 to open under the spring bias, until the projections 55,57 on the flap extension 56 reach the lowermost point of their respective
30 slots 53,54. It will be appreciated that the attitude of the flap 16 remains constant as the handle is pushed downwardly as hereinbefore described.

[0062] In this position, as shown in Figure 11, the flap 16 can be retained in the partially open position by maintaining
35 a downward bias on the handle 58. Fine dirt and dust at the

bottom of the bin 14 can be emptied through the small opening at the bottom of the bin 14. Any coarse dirt and fibrous matter cannot pass through the opening and is retained inside the bin 14.

5 **[0063]** In order to fully empty the bin 14, the user has to pull the lower edge of the handle 58 away from the bin 14, causing the lower projections 57 to slide along the bottom of their respective u-shaped slots 54, allowing the flap 16 to pivot further open about an axis extending through the upper
10 projections 55. The downwards force on the handle 58 is then released, thereby causing the lower projections 57 to move a short distance up the short arms 54b of the lower slots 54. The spring 59 serves to retain the flap 16 in this fully open position, as shown in Figure 11, in which all of the remaining
15 dirt and dust inside the bin 14 is free to fall through the open bottom of the bin 14.

[0064] Following emptying of the bin 14, the handle 58 is pushed downwardly and then inwardly, thereby allowing the flap to close under the applied spring bias. The body 11 of the
20 cleaner is preferably adapted such that the bin 14 cannot be mounted to the cleaner until the flap 16 has been closed, thereby avoiding the risk of dirt and dust escaping from the bin when in use.

[0065] A bin in accordance with the present invention is
25 simple and inexpensive in construction, yet allows a staged discharge of fine and coarse dirt, thereby minimising the risks of dust contamination during emptying.

[0066] Whilst an upright vacuum cleaner has been shown and described in the drawings, it will be appreciated that the
30 present invention is equally applicable to a canister or other type of vacuum cleaner.

[0067] Reference is made to our co-pending US applications claiming priority from United Kingdom Patent Application Nos. 0307929.0 and 0307930.8 of 5th April 2003, the disclosures of
35 which are incorporated herein by reference.

[0068] While the preferred embodiments of the invention have been shown and described, it will be understood by those skilled in the art that changes or modifications may be made thereto without departing from the true spirit and scope of the
5 invention.